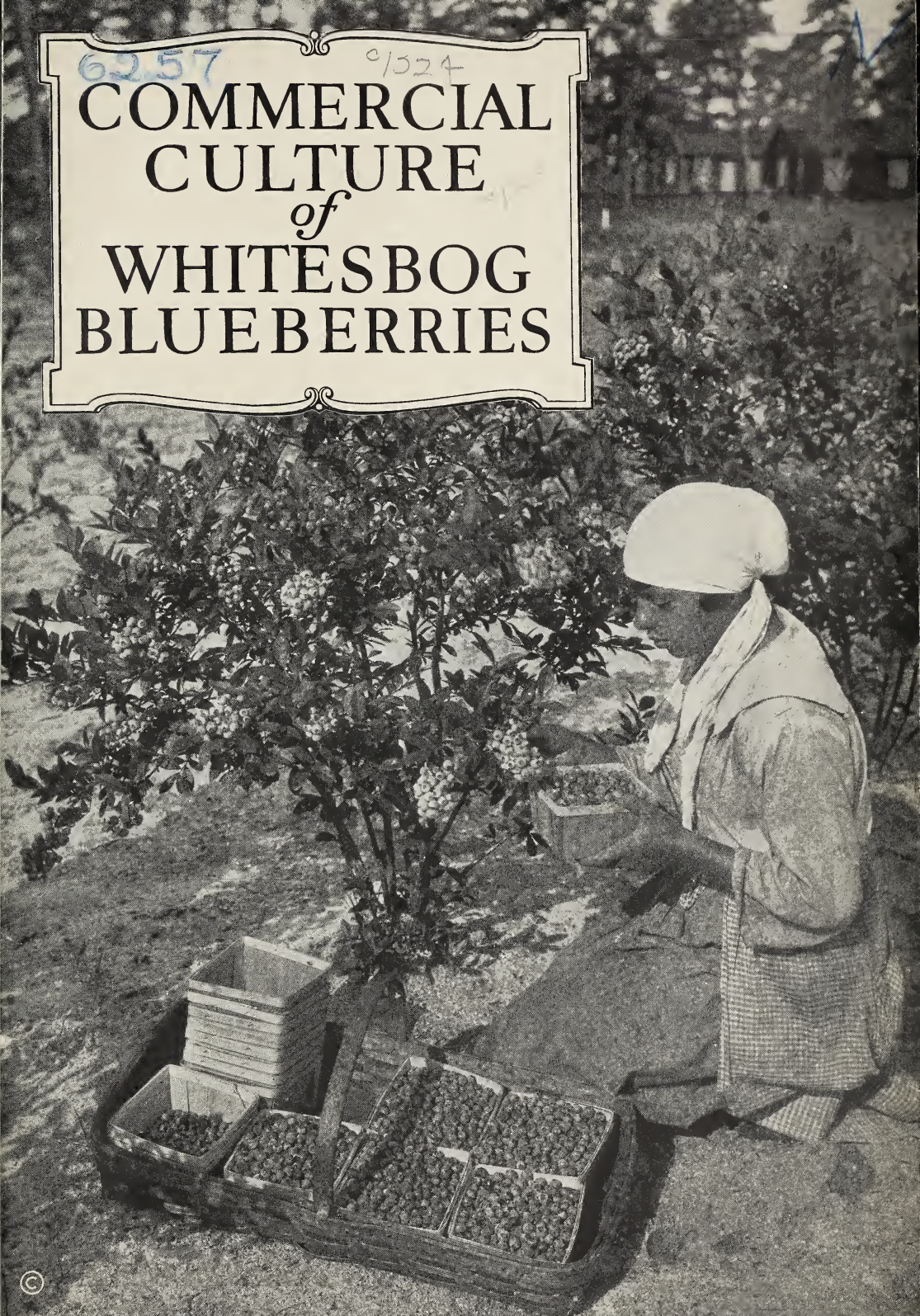


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COMMERCIAL CULTURE *of* WHITESBOG BLUEBERRIES



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THIS booklet has been prepared to help those who are interested in the commercial culture of Blueberries but who are unable to visit Whitesbog to secure first-hand information.

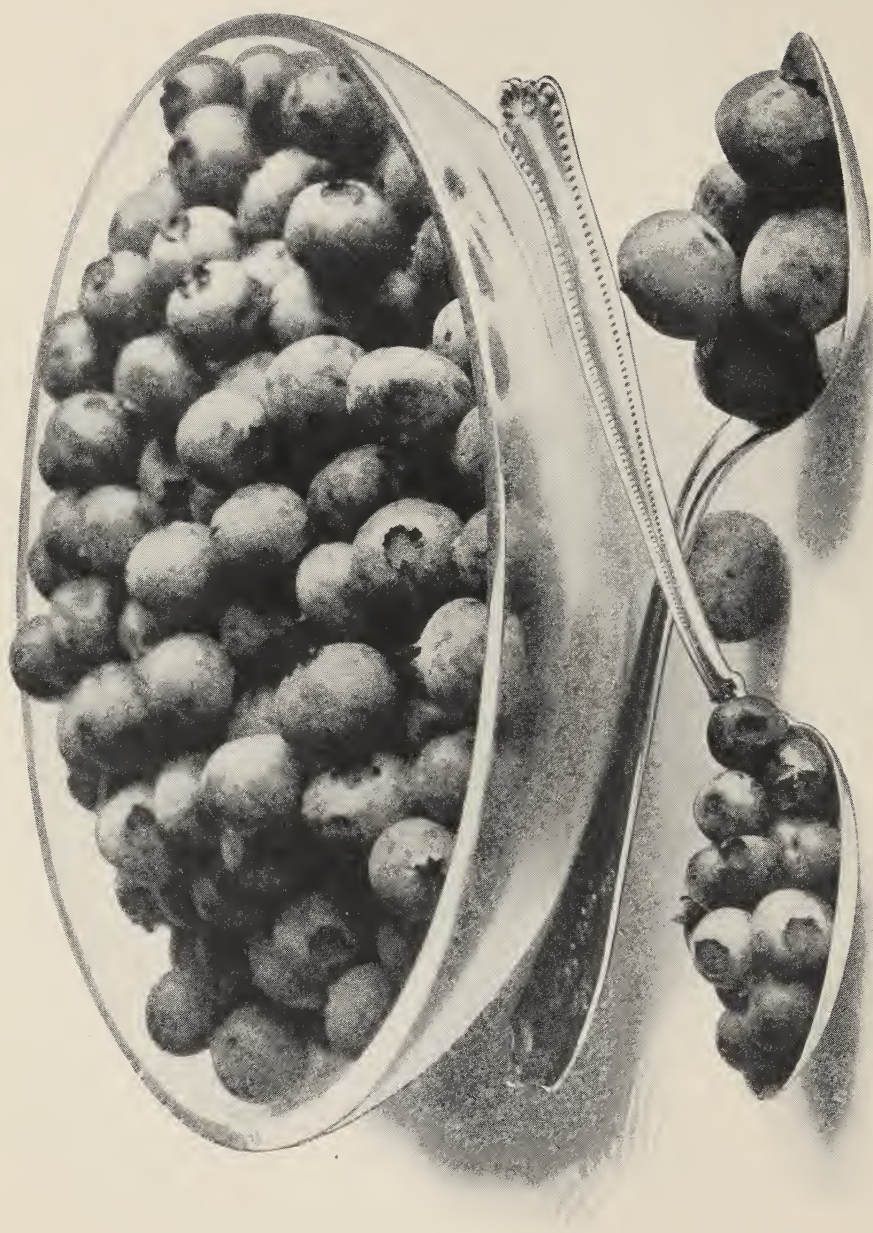
It is necessarily confined chiefly to a description of the methods found successful with the highbush blueberry, as worked out at Whitesbog by Elizabeth C. White and S. B. Hutton. Conditions in other locations equally well adapted to blueberries may be very different from those at Whitesbog, but even so, we believe our experience will be found to contain many helpful suggestions.

JOSEPH J. WHITE, INC.,
Whitesbog, New Jersey

*The illustration on the cover shows a Rubel bush
three years and four months after it was planted*

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WILD BLUEBERRIES AND WHITESBOG BLUEBERRIES

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Different Kinds of Blueberries

WE are frequently asked, "What is the difference between the huckleberry and the blueberry?" In New England the distinction is recognized. In many other states, especially in the South and West, the name "huckleberry" is applied to both the blueberry and the huckleberry. There is, however, a real difference. The huckleberry has ten large hard seeds, that crackle between the teeth like blackberry seeds, while the blueberry has a large number of small soft seeds which are practically unnoticed when the berries are eaten. Consequently many people speak of the blueberry as seedless.

There are several different kinds or species of wild blueberries of which three are especially noteworthy for their commercial value. The lowbush blueberry (*Vaccinium angustifolium*, also called *Vaccinium pennsylvanicum*) is found in parts of most of the Northeastern states, about the Great Lakes and in Canada. The bushes of this species grow only 6 to 12 inches high. In New Jersey, where it is sometimes called the "Juny," the berries begin to ripen early in June. In Maine this lowbush blueberry covers thousands of acres to which some care is given, chiefly by periodic burning, and the fruit supplies a great canning industry.

The rabbiteye blueberry, sometimes called the "tree huckleberry" (*Vaccinium virgatum*), grows 10 to 12 feet high and is found in northern Florida and other Southern states. This blueberry has been cultivated near Crestview, Florida, with considerable success, but little has been done to select especially fine varieties.

The species chiefly cultivated at Whitesbog is the highbush blueberry (*Vaccinium corymbosum*), commonly known in New Jersey and many Southern and Western states as the "swamp huckleberry" or sometimes as the "big blue." This species which has produced the largest known blueberries promises to be of the greatest commercial value wherever it will thrive. It is found wild along the coast of Maine and throughout the other New England states, in the southern parts of Wisconsin and Minnesota, in Michigan and other states bordering the Great Lakes. Its natural range extends well down into the Southern states, especially in the mountains. It is probable that this natural range can be extended by selection and cultivation.

How Cultivation Was Started

Blueberry development began in 1906 when the interest of Doctor Frederick V. Coville, Chief Botanist of the U. S. Department of Agriculture, was first attracted to blueberries. He started experiments in 1907 and by 1910 he had worked out the fundamentals upon which the

later developments of blueberry culture have been based. These he published in Bureau of Plant Industry Bulletin No. 193 under the title of "Experiments in Blueberry Culture."*

Elizabeth C. White, daughter of Joseph J. White, read this bulletin and realized that the success of Dr. Coville's experiments pointed the way to the realization of her girlhood dream of cultivating the blueberries which grew wild about her father's cranberry bogs in the Pine Barrens of New Jersey. She wrote to the Department of Agriculture offering to co-operate in Dr. Coville's further experiments. This resulted several years later in the establishment of the Government blueberry trial ground at Whitesbog.

Methods of Selection

The first need was to secure plants that would produce fruit of superior size and quality.

To obtain such plants, Miss White, with cash and friendliness, induced the pickers of wild blueberries to search for exceptionally fine bushes. During the summers of 1911 to 1916 over one hundred bushes were located, most of which bore berries $\frac{5}{8}$ of an inch or more in diameter. These were dug the Fall after they were located and taken to Whitesbog.

The bushes were divided and as many plants as possible produced from each, ranging from twenty-five to two hundred.

Each of the original wild plants formed the beginning of a variety and as the new plants were grown from cuttings, each was true to the type of the wild plant from which the cutting had been taken.

In their original location it seemed probable that the large size of the berries on some of these wild plants might be due to especially favorable environment, but when each was increased to twenty-five or more plants which were grown under the same conditions of soil and culture the actual characteristics of each group of plants became evident.

In four to five years after the discovery of the original bush, the young plants grown from it began to fruit and the different varieties were carefully studied and compared in order to select the best for our own fruit production on a large scale. Careful consideration was given to such qualities as the size, color, flavor and texture of berries, size of crop, vigor of plant growth and resistance to frost damage and winter killing. Six varieties only were retained, of which Adams may be classed as an early berry, Harding, Sam and Dunfee as midseason and Rubel and Grover as late.

Plants grown from these wild bushes were given to the Government

*This is now out of print. It was followed by "Directions for Blueberry Culture, 1921," published as Bulletin No. 974 by the U. S. Department of Agriculture.

for Dr. Coville to use in breeding better varieties. So far, more than 25,000 hybrids have been raised from seed by Dr. Coville and tested at Whitesbog. Over 90 per cent of these hybrids have had, for one or both parents, plants from the New Jersey swamps which we have furnished.

The hybridizing is done by taking the pollen from the flower of one variety and placing it on the pistil of the flower of another variety. These two varieties are the parents of the plants grown from the seeds of the resulting berry. Seedling plants of the same parentage have a certain family resemblance, yet no two of the plants are exactly alike and each separate seedling is the possible beginning of a new variety. These seedlings have many of the characteristics of each parent in varying degrees and occasionally one is found that is better than either parent. Dr. Coville may, therefore, cross an early variety producing medium sized berries with a late variety producing large berries, in the reasonable hope of securing a seedling which will produce early berries of large size.

Of the 25,000 hybrids that have fruited so far, only three have been approved by the Department of Agriculture as suitable for distribution. These varieties have been named Pioneer, Cabot and Katherine. All three are being planted at Whitesbog for commercial fruit production.

Requirements for Blueberry Culture

A knowledge of the conditions under which wild blueberries grow is of great help in understanding their requirements under cultivation. The essentials according to Dr. Coville are: (1) an acid soil, preferably one containing peat* or partially decayed vegetable matter; (2) an abundant supply of soil moisture; and (3) good drainage so that the roots can get air during the growing season. These conditions, under which the highbush blueberry thrives, are found in widely different situations. In southern New Jersey, where the light sandy soil holds moisture poorly, the wild bushes are found only in low swampy places. In other localities, especially in New England, vigorous plants of the same species produce large crops of fine berries on hillsides and in well drained pastures. In such locations it seems that the soil must have excellent capacity for holding moisture.

* The words "peat" and "muck" have often been used interchangeably, to denote soil composed of decaying vegetable matter. Dr. Coville, however, is using the word peat only for such soils of acid reaction, while the non-acid soils he calls muck. In hundreds of experiments he has shown conclusively that while the ordinary plants of agriculture thrive in a soil that contains the non-acid muck, there are many other plants which die in such a soil, and require for thrifty growth peat or its acid equivalent.

Blueberries are of this type of plants, and throughout this booklet the word peat is used to indicate an acid soil composed of decaying vegetable matter.



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PIONEER, ACTUAL SIZE

Soil Requirements

The most essential requirement for blueberry culture is a soil that is acid or sour and therefore contains no free lime or alkali. Dr. Coville's experiments have shown that lime is poison to blueberries and that plants set out in a soil containing lime make no root growth, but soon weaken and die.

We are growing our cultivated blueberries in a soil composed of a mixture of sand and peat where wild blueberries formerly grew. A large proportion of the soil we are using is very sandy and has less peat than we consider desirable but we are getting good crops. A grower near us has set out several acres of blueberries on an old cranberry bog which had a water supply inadequate for successful cranberry culture. His soil contains a much greater proportion of peat than ours, and his plants are making excellent growth. It seems reasonable to expect that his soil will hold moisture better than ours and will require less fertilizer. A customer in southern Alaska reports that plants he secured from us have grown well in pure peat soil.

Blueberries prefer a light soil that can be kept in a loose, friable condition during the growing season. It seems unlikely that they will thrive in a heavy loam or clay.

There are doubtless soils on which blueberries are not now growing, or have never grown, that will prove adapted to them. If the land is acid or sour, contains an ample supply of moisture, and is not too heavy, it is worth while to experiment, but extensive planting is not recommended until such soil has been tested by growing a few plants.

As there are extensive areas suited to the cultivation of the blueberry, it does not seem desirable to adapt unsuitable soil to commercial culture. The fertilizer, acid phosphate, will not make soil acid.

In a garden the soil can be prepared for a few plants by adding rotten leaves, rotten sawdust, or peat, but this is too expensive to undertake on a large scale. We will furnish complete directions for garden culture on request.

Moisture and Drainage

Blueberry plants may survive a season unfavorably wet or dry, but crops are uncertain unless the supply of moisture is well balanced. Careful investigation of possible water supply and drainage should therefore be made before deciding on a location for commercial blueberry culture. Some locations may naturally have an abundant water supply and require artificial drainage; others may require irrigation while drainage takes care of itself.

In many cases wild blueberries are found growing in swamps with their roots covered by water during a considerable part of the year.

Careful observation, however, will show that they are perched on hummocks and that at some time during the growing season, the water is low enough so the roots growing in the light porous material of the hummock can get air.

Knowing the very wet situations in which wild blueberries grow, it took several years for us to learn that under cultivation they will not thrive in ground that is continuously wet and soggy during the growing season. We now underdrain the wet spots in our fields with 4-inch tile laid from 20 to 30 inches deep. Water standing at or near the surface of the ground for two or three days during the growing season will not seriously damage the plants, but best results are obtained if the land is sufficiently well drained to be cultivated within four or five days after a rain. During the winter water standing at or near the ground surface will cause no damage; in fact, after the plants become well established, water standing several inches over the ground until the plants start spring growth will do no harm.

With good drainage it is equally important that there should be an ample supply of moisture available during the growing season, especially while the berries are ripening. In a soil that holds moisture well or in which the capillary action is good the water table may be several feet below the surface in fruiting time without injury to the crop, but in a loose textured sandy soil the water table should be within 2 feet of the surface or irrigation should be provided.

Our blueberry fields have underground irrigation provided by the seepage water that escapes through the dams of the reservoirs maintained for cranberries. This seepage water follows along on top of a hardpan from 20 to 30 inches below the surface of the ground and furnishes all the moisture the plants need except during occasional extended spells of hot, dry weather while the fruit is ripening. Of course, this kind of sub-irrigation is not necessary under all conditions, but it is of great benefit in our exceedingly sandy soil.

Land that is moist enough to produce a full crop of strawberries in a very dry season can be considered moist enough for blueberries.

Preparing the Land

All of the ground planted with blueberries at Whitesbog is wild land cleared especially for them. First, any timber is cut and then the brush is cut and burned. The stumps, which are nearly all pine with very few over one foot in diameter, are grubbed out by hand. We experimented with dynamiting them, but found it much more expensive than hand-grubbing, as the stumps are comparatively small and in many cases scattered.

The land is broken with a tractor-drawn new-ground plow, throwing



BREAKING WILD LAND

Note the three to four inches of black peaty soil underlaid with white sand. We consider six to eight inches of peaty soil preferable. The plow is a No. 41 Oliver Brush Breaker with a 20-inch bottom

a single furrow 16 to 20 inches wide. We usually plow about 8 inches deep and plan to turn up at least 1 or 2 inches of the sandy sub-soil to cover the peaty turf so that it will rot more quickly. The best time to plow new ground is during July and August, as the wild plants are then more easily killed than at any other time of year.

The land is disked shortly after plowing and often enough thereafter to keep the wild plants from growing. It is not advisable to set out blueberries until the wild growth has been practically all killed and the

small roots and bushes plowed under have rotted fairly well. Blueberries occupy the land for many years, and it is desirable to have it in the very best condition before they are planted. In some cases we are able to set the plants one year after the land has been plowed, but usually find it better to wait two years. Where suitable cleared land is available, this delay is unnecessary.

Spacing the Plants

After experimenting with various spacing we have fixed upon 8 feet as the best distance between rows, and 4 feet between plants in the row. This spacing requires 1361 plants per acre. It allows plenty of room for cultivation between the rows and for the pickers to work without knocking off berries. Four feet between the plants in the row allows room to cultivate across the rows with a one-horse cultivator for two or three years after the plants are set out. Later, the bushes touch and it is impracticable to cultivate across the rows. Where it is desirable to eliminate all hand-cultivation, we advise spacing the plants six feet apart in the row. This will provide ample room to cultivate between the rows with a team and across the rows with a one-horse cultivator. Mature plants, if kept pruned, will probably range from 4 to 6 feet high.

Plants

We are convinced it pays to set only nursery grown plants of selected, tested varieties.

We are occasionally asked how to develop a plantation of cultivated blueberries from wild plants. The selection and development of the Whitesbog varieties, of which the first commercial fields are just coming into bearing, has involved over 12 years of hard, tedious, expensive and often discouraging work. Many thousands, probably hundreds of thousands, of wild plants were inspected by blueberry pickers in their search for the 100 bushes chosen for trial under cultivation and from which only six varieties were selected.

In the selection of the three Coville Hybrids approved for distribution over 25,000 seedling plants of superior parentage were grown to fruiting size and carefully examined and compared.

The extensive tests carried on at Whitesbog have required more than 20 acres of land. Most of the plants on these 20 acres produce berries much superior to those of the average wild plants. These berries command a ready sale, but the fruit of the Whitesbog varieties is so much better that we are grubbing out acres of trial bushes to replace them with the named varieties.

We believe it will not pay others to traverse the long road over which

we have passed. If, however, you know of one or two wild plants that produce such exceptional berries that you think them worth the time and trouble, we offer the following suggestions to guide you:

Dig the bushes after the leaves drop in the fall and before they start to grow in the spring. The top of the bush should be cut off about 2 inches above the ground. The stump, including the 2 inches of stem and the larger roots should be divided by vigorous use of hatchet and saw, leaving a stem and a portion of large root on each piece. These pieces which have some top and some root are known as "stem bases." They should be planted with the stem sticking just out of the ground in good blueberry soil that will keep moist, or can be watered. A location that is shady for part of the day is to be preferred. Practically all of these will grow. They should not be disturbed for a full year. By that time they should be nice young plants ready to be set in their permanent location.

In our work we also make cuttings of the tops, but these must be rooted under glass and require constant expert care.

Budding and Grafting

Budding or grafting is useful in experimental work with blueberries, but is not practicable for fruit production on a commercial scale. It is the nature of the blueberry bush to renew itself from the root. A budded plant persistently sends out shoots from the stock below the bud. These vigorous shoots soon crowd out the growth from the bud unless promptly removed. There are so many of them to be taken off every few weeks that the cost is prohibitive. Even with the best of care the budded stem loses its vigor in comparatively few years. The only practical plan is to use plants grown on their own roots.

Planting

Blueberry plants can be set out either in the fall or early spring. It is not advisable to ship them to a distance in the fall, so spring planting is best unless you are so situated that you can get the plants by truck.

With plants close at hand they can be set out at any time after August 20th. The best time for fall planting is during the last few days of August and the first half of September. Plants set then will not make new top growth, but will make vigorous root growth until the ground freezes, and will become firmly established in their new location before winter. In setting plants in the fall great care must be taken to get moist soil packed around their roots.

When the plants are to be set out in the spring it should be done just as early as it is possible to get on the land after the frost is out. We find



PICKING BLUEBERRIES IN THE FIELD
These plants were set in the field in September, 1911.

it best to have our land fully prepared the preceding fall so there will be no delay when planting time arrives. In New Jersey it is best to have the planting done before April 15th, although the plants can be set out without great risk as late as April 30th.

Care Before Planting

Plants received while still dormant and before the ground is fit to set them out should be left in the boxes in which they are packed and put in a cold place where they will not dry out. Freezing will not hurt them, but frequent freezing and thawing is to be avoided. As soon as the ground can be worked or the temperature where the plants are stored runs over 40 degrees for several days, they should be unpacked and planted or "heeled in."

Plants which have started to grow when received should be unpacked at once and the tops exposed to the air and light in a shady place for a few days until the leaves and buds have turned dark green. Otherwise, the pale leaves that have developed in the package will fall off when exposed to direct sunlight.

In warm weather when plants have to be kept for a few days before they are planted they should be "heeled in" in a moist shady place. This consists of digging a shallow trench with one side sloping, placing the



TESTING FIELD AT WHITESBOG
ber, 1916. Photograph taken July, 1923

plants along this sloping side of the trench and covering the roots with moist soil. They should be watched carefully to see that the roots do not dry out.

Setting Out the Plants

In order to set the plants in straight rows we mark the field in both directions with a striking-out sled and set the plants where the sled furrows cross.

Great care must be taken to keep the roots of the plants well covered with moist soil or moss while they are being handled. Do not let the sun strike the roots. We take the plants to the field in large boxes or crates and transfer them to small boxes or baskets which are carried along the row while the plants are being set. As the plants are transferred to these small boxes a little moist earth is thrown over the roots. If the top soil is dry it is scraped away from where the plant is to be set and then a hole is dug with a large trowel or spade. The plant should be set at least a half inch deeper than it grew in the nursery. It does not injure it to put it an inch deeper, or if the soil is dry, even two inches deeper will do no harm. We have never found it necessary to water the plants, but moist soil should be packed very firmly around the roots. When the planting is completed, the plants should be so firmly in the ground that the roots cannot be easily moved by taking hold of the stem at the ground level.

Plant at Least Two Varieties

Like some other fruits, blueberries will not set a good crop of fruit unless at least two varieties are planted together. We usually plant alternate rows of two varieties ripening about the same time, but have one small field with three rows of one variety to one row of another. Until further experience has been secured, however, we advise alternating rows as being the safest practice.

Wild blueberry bushes growing near plants under cultivation will have no harmful effect upon the fruit of the cultivated bushes, but plants grown from the seed of berries resulting from such pollination would combine the characteristics of the wild plants with those of the cultivated varieties.

Fertilizer

Commercial fertilizer has been of great benefit to our blueberry plants. We have been applying about 400 pounds to the acre since 1919, but always leave a few plants without it in order to see the benefit secured. The fertilized plants have always been more healthy and vigorous and have produced larger berries and more of them. We prepare the fertilizer ourselves following a formula developed by the New Jersey Agricultural Experiment Station as especially suitable for cranberries. Under our conditions this cranberry fertilizer is so satisfactory on blueberries that we advise using it if the materials can be obtained. The formula is as follows:



PLANTS FROM WHITESBOG BLUEBERRY NURSERIES

Note method of "heeling in" to keep plants in good condition until they can be set in the field

100 lbs. nitrate of soda
260 lbs. finely ground rock phosphate
40 lbs. sulphate of potash
—
400 lbs.

This analyzes approximately 4-18-5. While the rock phosphate is not available for the use of the plants when it is first applied, it slowly becomes available in the acid soils in which blueberries thrive. The first year that this fertilizer is used it might be an advantage to add 100 pounds of acid phosphate so that some phosphorus may be immediately available.

If the rock phosphate cannot be obtained, the same amount of acid phosphate may be substituted for it. This will analyze approximately 4-10-5. The phosphate will be more quickly available but will not last so long.

The fertilizer is applied early in May at the time of the first cultivation. It is broadcasted between the rows, keeping it about a foot away from the plants, and harrowed into the soil at once. Probably a better



CULTIVATION WITH A SPRING-TOOTH HARROW

The mellowing and good aeration accomplished in the white, sandy soil at Whitesbog with the spring-tooth harrow is well shown in this picture. Cultivation should not be over 1½ to 2 inches deep, for blueberry roots make their principal development within 8 inches of the surface. The plants here shown are at 4-foot intervals in rows 8 feet apart. (Reprinted from Plate xxiv, Bul. 974, U. S. Dept. of Agriculture.)

method would be to use a small fertilizer drill that could be worked between the rows and that would drill it directly into the soil. For small plants the first and second years after they have been set out, it is unnecessary to spread the fertilizer entirely across the row. We spread it around each plant in a band 12 inches to 18 inches wide, keeping it at least 6 inches from the plant, and then work it in with a cultivator or hoe. Care must be used to get as little as possible on the leaves as it will sometimes burn them.

Until more is learned about the cultivation of blueberries, fertilizer should be used with care and judgment. It seems probable that on soils containing a large proportion of peat it will be advisable to use less than we do. Nitrate of soda or sulphate of ammonia should not be used alone. While we have sometimes secured good results with these fertilizers they frequently injure the plants. On small scale experiments we have obtained good results on nursery plants with cottonseed meal applied at the rate of $\frac{1}{4}$ to $\frac{1}{2}$ pound to the plant. While this might be used on a few hundred plants, it is too expensive to be used on large areas, as the mixture described above is not only cheaper but will probably give better results on bearing plants.

As wood ashes contain lime and other alkaline material they should not be applied to blueberry plants. The benefit resulting from burning lowbush blueberries, as practiced in Maine, is from the pruning effect of the fire. The resulting ashes are generally insufficient to have any noticeably injurious effect.

Stable manure should not be used, for though it may at first appear to be of benefit, it is likely to cause damage later. If the land is deficient in decaying vegetable matter, it can be improved by applying peat or rotten sawdust and thoroughly working it into the soil.

Cultivation

Thorough and frequent cultivation is necessary to secure the best results with blueberries. It not only keeps down the weeds, but also loosens up the soil so that the roots can get the air which they need in order to make the best growth. We allowed one of our small fields to grow up to sod several years ago and have kept it in sod since. The quality and quantity of the berries from this field have since deteriorated. Young plants which are kept well cultivated and hoed make much more vigorous growth than plants which are not cultivated.

Our cultivation is done with one 12-tooth section of a spring-tooth harrow drawn by a team. The harrow is set to cultivate only $1\frac{1}{2}$ to 2 inches deep, for the roots are near the surface. Two trips are made to each row in order to get as close to the plants as possible without striking them. One team can cultivate about six acres a day. During the first two or three years after the plants are set out, we cultivate across the

rows with a one-horse cultivator. After that, there is not room to get between the plants without damaging them. If plants were spaced 6 feet apart in the row, we believe cross-cultivation could be kept up permanently, and very little hand work would be necessary.

If there is a heavy growth of weeds between the rows, or a cover-crop to be worked in, a disk harrow can be used, but care must be taken not to work the soil too deep. As a disk harrow has a tendency to hill up the soil if used with the disks set the same way at each cultivation, it is best to set it to throw the soil away from the plants at one cultivation and toward them at the next. Or the disks can be used with very little set, so that they just chop up the weeds or cover crop and do not ridge up the soil. We use a disk only for the first cultivation in the spring and not then unless the soil is covered with weeds and growth that will clog a spring-tooth harrow.

We start cultivation between the 1st and 10th of May, which is usually just as the blossoms are falling. It is continued at intervals of two to three weeks until about the middle of July and is then discontinued for the season. During this period it is desirable to cultivate frequently enough to keep down weeds and to loosen up the soil within a few days after every hard rain.

Hand Hoeing

As long as blueberries can be cultivated in both directions, very little hand hoeing is necessary, although we like to work around the small plants with a hoe two or three times during the season to loosen the soil and chop out any weeds that are too close to be destroyed by the cultivator. After the plants get too large for cross-cultivation, we hoe between the plants in the row often enough to keep down the weeds until the middle of July. We usually find two to three hoeings a season ample.

Pruning

The only pruning that is necessary the first year is to cut off all flower buds. This should be done before the flowers open, if possible. Do not fail to remove these buds, as small plants are not strong enough to produce any quantity of fruit and the effort to do so will materially reduce the amount of growth. We advise removing the flower buds the second spring also, in order to force the plants to make as much growth as possible and produce a really good crop the third summer.

No further pruning is necessary until the plants are four or five years old. After that we go through the fields each winter to cut out the twiggy growth near the bottom and remove a few of the older stems from each plant. The young wood produces the best fruit and



A RUBEL PLANT, FOUR YEARS OLD, BEFORE AND AFTER PRUNING

the removal of the oldest wood provides space for vigorous new shoots to grow up from the root during the following season.

We prefer to go over the plants every winter after they are four years old and prune moderately, rather than to prune more heavily every two or three years. The prunings are thrown between the rows, raked up with a fork, carried to the edge of the field and burned.

Diseases and Insects

Our blueberries have never been seriously affected either by insects or diseases and we have never had to spray them. We have an occasional stem-borer, but when we find one we cut off the stem below where it is working and it can do no further damage. Occasionally colonies of caterpillars are found on the plants. The branches on which they are found are cut off and the caterpillars killed.

The leaves on some of our bushes show mildew and leaf-spot during the latter part of the summer, especially if we have much foggy, damp weather, but this does not appear to cause any particular damage. Almost every season we have a few "mummy berries" or berries affected by a disease which causes them to dry up and drop off the bushes before they ripen. While the loss from this cause varies from year to year, it has never been serious.

The fact that blueberries do not require spraying is one of their great advantages.

Rabbits

Rabbits are fond of the young twigs of blueberry plants and in small plantings may do considerable damage. In our large fields the injury is negligible. If protected for the first two or three winters, the plants grow out of reach of the rabbits. We have never known them to injure the bark of the older stems.

FLOWER AND LEAF BUDS

The six large buds on the end of the twig will develop into clusters of flowers while the smaller buds below will develop into leaves and branches. (Reprinted from Plate 10, Fig. 1, Bul. 193, U. S. Dept. of Agriculture.)



Picking the Berries

Blueberry picking is pleasant work. The bushes are of a convenient height and have no thorns or other unpleasant qualities. Our berries are picked by Italian women and children belonging to the families of the men employed on our cranberry bogs during the summer.

The berries in the trial fields begin to ripen the latter part of June and continue until early August. In the summer of 1922, we picked from June 20th to August 8th, and in 1923 from June 25th to August 12th. We did not pick every day during the latter part of June and in August, but picked every week day during July. Adams and Cabot, our earliest selected varieties are usually not ready to pick until the first of July, but Rubel and Grover, our latest selected varieties, are the last berries we pick. The berries ripen slowly, and each bush has to be picked from three to four times. We have found the best interval between pickings to be six to eight days. If picked oftener the pickers get too large a proportion of berries not fully ripe or full size; if they go longer and a spell of wet weather comes, some of the berries soften or crack open.

To avoid unnecessary handling, the berries are picked directly into the quart baskets in which they are shipped. The rule is to fill these quarts heaping full and keep them free of leaves, unripe berries and trash of any kind.

The pickers are paid 6 cents a quart and make good wages. An occasional picker during the height of the season picks 90 to 100 quarts in a nine-hour day. The entire group of thirty pickers, including slow old women and children working intermittently, has averaged 50 quarts a day for several days at a time during the height of the season.

The women tie the quart box in which they are picking at their waist with an apron, leaving both hands free. The boys and girls either tie their quarts in an apron or hold them between their knees, but all first-class pickers use both hands. The hand is held underneath the cluster of berries and the ripe berries shelled off with the thumb and fingers. An experienced picker does it very quickly. The pickers place the full quarts in 8-quart carrier baskets and deliver them to the packing shed, located at the edge of the field. Here the berries are inspected and the picker's ticket is punched. The tickets are each for 100 quarts.

Inspection usually consists of superficial examination for quantity and quality, but occasionally, the berries are turned out of one quart into another. The woman in charge soon learns which pickers she can rely on for uniformly good work. Any soft or green berries showing on top are picked off with a pair of tweezers as it is difficult to get hold of them with the fingers without mashing other berries. The quarts are then covered with paper caps secured by gummed paper tape. These caps keep the berries from spilling and also add to the appearance of the package. The covers can be put on very rapidly by skilled girls. The covered quarts are packed in 32-quart crates. They are usually shipped the afternoon of the day the berries are picked, but in case of emergency may be held a day or two without loss.

The berries are graded into two classes. The paper caps used on the finest have a trade mark printed on them while the smaller berries from



GOOD PICKERS USE BOTH HANDS

the last picking or those that are a little soft or not strictly fancy in every respect are covered with plain caps.

We are sometimes asked whether it would not be possible to gather the berries with a scoop or rake or by shaking the ripe berries into a basket or sheet as is done with wild berries. We do not consider it advisable to use any of these methods. The large ripe berries would be bruised by scoops and the green berries would be destroyed instead of being left to ripen. Blueberries sufficiently ripe to be shaken off are too soft to be marketed in good condition.

Whitesbog blueberries are a fancy fruit and bring fancy prices when carefully picked and packed. It is not sufficient to grow good fruit; it must also be gathered and packed in such a way as to reach the consumer in attractive condition. For a fine product, delivered in good condition, the consumer gladly pays a top price.



PACKING BLUEBERRIES

A cover of tough paper is fastened on each quart with gummed paper tape. Note the finished package on the left

Hardiness

Whitesbog blueberries have been selected for resistance to winter-killing and damage by late frosts. The crop on the selected varieties has been practically undamaged in years when almost the entire crop of wild blueberries in our locality has been killed by a late frost and the crop on the miscellaneous plants under trial at Whitesbog has suffered to some extent.

A customer in the Adirondack Mountains in northern New York writes that the plants which he set out in 1921 have been hardy; and another customer in northern Wisconsin writes that plants secured in 1921 passed through a temperature of 20 degrees below zero without damage when there was little snow to protect them. We believe that the plants will prove hardy in the northeastern United States and south-eastern Canada, but think there may be some question whether they will endure the winters of the northernmost parts of Wisconsin, Michigan and Minnesota. In these very cold climates commercial culture of Whitesbog blueberries cannot be advised until tests of the plants have been carried further than at present.

The southern limit of commercial culture of these varieties is also somewhat indefinite. Dr. Coville has proven by experiment that they will not make a satisfactory growth unless subjected to chilling temperatures during the winter. Just how cold a temperature is required or how long it must last is as yet unknown, but we find that our plants will start satisfactorily after being kept at a temperature of 32 to 40 degrees for six or seven weeks.

Bearing Age

While blueberry plants may produce a few berries the first summer and two or three crates per acre the second summer, we consider it better to cut off all flowers the first two seasons in order to throw the full strength of the plant into making a strong, vigorous bush that will produce a good commercial crop the third summer. In 1922, from plants set in the trial field in the fall of 1919, we picked 150 crates of 32 quarts each from $2\frac{1}{2}$ acres. An acre of the selected varieties will produce better crops than an acre of plants under trial, because of the better average quality of the plants. Under ordinary conditions we expect the crop to increase until at least the fifth or sixth year after the plants are set out. As we have been cultivating blueberries for only twelve years, we do not know the profitable life of a commercial field. Individual wild bushes are known to have produced crops for over fifty years. As the top of the blueberry plant can be renewed by cutting out the older stems it seems probable that profitable crops can be secured for many years. We look upon our fields as being at least as permanent as a well cared for apple orchard.

Yield

Our commercial shipments of blueberries, including the 1923 crop, total about 3000 crates. These have come almost entirely from the seedling plants in the trial fields. Of the selected Whitesbog varieties only a few plants have been allowed to produce fruit each year; the tops of all the others being used for cuttings. Several acres of the named varieties will produce a commercial crop in 1924.

From the plants under trial we have secured crops of from 60 to 110 crates, of 32 quarts each, to the acre. The selected varieties produce much larger berries and are far better yielders than most of these and we look forward to averaging at least 100 crates to the acre from mature plants. The original plant of Pioneer during its fourth year in the field produced a crop of $2\frac{1}{2}$ quarts or, with plants set 4 by 8 feet, at the rate of over 100 crates to the acre for the second commercial crop. Many other individual bushes produce from two to three quarts a season.

Cost of Producing Blueberries

The cost of preparing land for blueberries varies greatly. We have cleared wild land at a cost of \$50 to \$100 per acre, but an occasional acre containing many large stumps has cost \$200. If the land is already cleared and it is only necessary to plow it, the cost is, of course, small. However, the profits from Whitesbog blueberries are sufficient to justify a considerable investment in preparing the land.

The cost of setting out plants is comparatively little as two or three men can set an acre in a day. During the first two years the expense of caring for the plants includes only the cost of fertilizer and cultivation. To the above items should be added the value of the land and of the plants to determine the cost of bringing them into bearing.

After the plants come into bearing the expense of caring for them is comparatively small. Cultivating four times costs about \$5 an acre for the season. Hand hoeing three to four times costs \$10 to \$15 an acre. In 1923 our fertilizer cost about \$10 an acre, including the labor of applying it. The cost of pruning will vary with the age of the bushes, the regularity with which it is done and, to some extent, with the variety. It will range from \$15 to \$25 an acre after the plants have been bearing for two or three years.

The cost of picking and packing a 32-quart crate is as follows:

Picking, including the extra berries used to fill up	
quarts.....	\$2.00
Foreman of pickers, covering quarts, packing, etc. . .	.25
Crate, quarts and paper covers.....	.80

\$3.05

Prices and Markets

At first our blueberries were sold direct to any one who would purchase a crate or more, but for several years practically our entire crop has been sold through one commission merchant in New York City. We find it much more satisfactory to have a reliable agent responsible for distribution, adjustments and collections. The prices returned are as good or better than those received under our first plan and payment is made more promptly.

In 1923 the price of our best grade of berries ranged from 45 cents to 55 cents a quart, and of the second grade from 35 cents to 45 cents. The net return for our 1923 crop of over 700 crates averaged \$11.97 per crate, after deducting commission and express charges. For our crop of 965 crates in 1922 the average was \$10.65 a crate. Our first crop of berries was picked in 1916. All of the berries marketed since, including many small ones from bushes under trial have averaged over \$10.00 a crate.



From National Geographic Magazine, Washington, D. C., Copyright, 1916

A QUART OF RUBEL BLUEBERRIES

As a commercial berry the Rubel is hard to surpass. The bushes are vigorous and produce heavy crops of light blue berries, many of which are over $\frac{3}{8}$ inch in diameter. The berries are unusually firm and keep on the bush in perfect condition for several days after ripening. Their shipping qualities are of the best

The crops and prices that we secure give a very satisfactory return per acre after deducting the cost of growing and picking the berries and these profits are soon sufficient to repay the investment required to bring the plants to bearing age. In many places a large crop could be sold at roadside markets or delivered direct to the consumer at even better prices than we obtain.

Whitesbog blueberries are not extravagant even at 50 cents or more per quart, because there is absolutely no waste; no pits, no peelings, no hulls and no empty spaces in the berries.

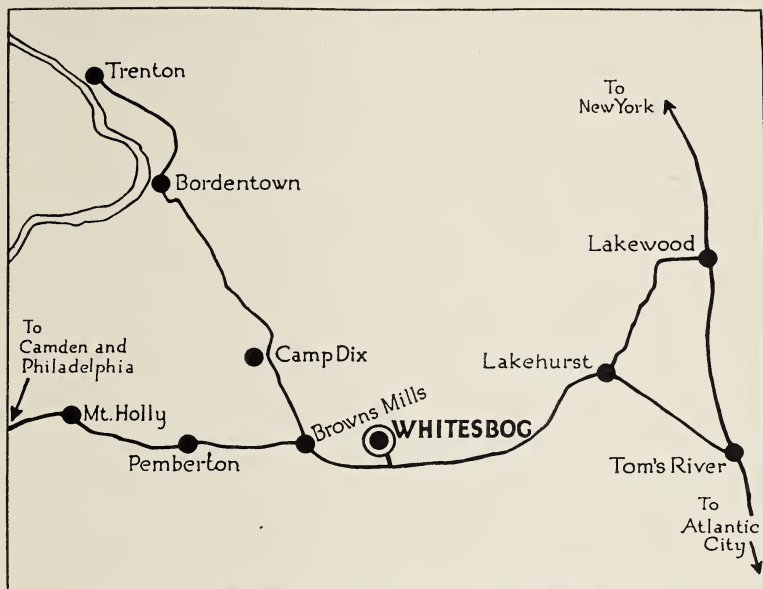
Since 1916, the first purchaser of our cultivated blueberries has served from 4 to 8 crates a week, during our season, in the restaurants of their excursion boats out of New York. They report these blueberries to be the most economical fruit they serve because of the absence of waste and the good keeping qualities.

During the past year dealers in Atlantic City, Philadelphia, Washington, Pittsburgh and other cities have sought to buy berries from us, but with so inadequate a supply we thought it inadvisable to enter other markets.

Market Possibilities

Immense quantities of wild blueberries are marketed in many parts of the United States. They are popular and usually command a good price. All the attractive qualities of the wild blueberries are retained and improved in Whitesbog blueberries, consequently the better fruit will be in demand as quickly as it becomes available. This waiting market is sufficient to consume all the cultivated blueberries that can be produced on many thousands of acres. The blueberry is a firm, solid fruit and will stand shipping better than other berries. This makes it unnecessary to sell in local markets if better prices can be obtained elsewhere.

We believe in co-operative marketing for farmers. For 28 years our cranberries have been sold through a co-operative sales company. We therefore look forward to a co-operative growers' organization to direct the sale of blueberries. Until there are sufficient growers of blueberries to make this practicable, we are in position to secure reliable information as to the dealer best able to give blueberry growers good service in any market in the United States. This we will gladly furnish to the purchasers of Whitesbog blueberry plants.



Roads to Whitesbog

Visitors are welcome at Whitesbog. We will be glad to show you our Blueberries and give you full information.

Whitesbog is on the road from Browns Mills to Lakehurst, four miles from Browns Mills and eleven miles from Lakehurst. The buildings of the village can be plainly seen from the gravel road.

From New York take the train to Lakehurst where an automobile can be secured.

From Philadelphia take the train at Market Street Ferry to Browns Mills if you wish an automobile, or to Upton (formerly called Hanover Farms) if you prefer to walk two miles.

Good meals and rooms can be secured in Browns Mills.

JOSEPH J. WHITE, INC.
WHITESBOG, N. J.

